Outcome of laparoscopic repair of perforated duodenal ulcers

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INTRODUCTION Laparoscopic simple closure (LSC) coupled with *Helicobacter pylori* eradication is a well-recognised treatment for perforated duodenal ulcers. This study aimed to evaluate its safety and efficacy.

METHODS This was a retrospective cohort study conducted on patients who underwent LSC of perforated duodenal ulcers from January 2002 to December 2009. Patients were stratified according to the American Society of Anesthesiologist classification and Boey's risk score.

RESULTS Of the 213 patients, 22 (10.3%) were excluded as they required conversion to open surgery. 191 (89.7%) patients who underwent successful laparoscopic repair were included in the study. The median age of the patients was 39 (range 19–73) years, and the majority were male (n = 180, 94%). Median duration of pre-hospital symptoms was eight hours and median time from admission to surgery was six hours. Median operative time was 65 minutes and median hospital stay was five days. Ten patients (median age 53.5 years) required intensive care unit admission. Two patients developed leakage from the suture line – one required re-exploration and the other was managed conservatively. Four patients had intra-abdominal abscesses – one required re-exploration, while three were managed by percutaneous radiological drainage. One patient developed pneumonia and one had pulmonary embolism. There were no surgical site infections. All patients were followed up as surgical outpatients (median duration 36 days). None of the patients required definitive surgery. There was one death in the cohort.

CONCLUSION LSC of perforated duodenal ulcers is a reliable, safe and minimally invasive procedure that has low morbidity.

Keywords: H. pylori eradication, laparoscopic repair, perforated peptic ulcer, proton pump inhibitors, triple therapy

INTRODUCTION

Despite a significant reduction in the number of elective surgeries performed for peptic ulcers, the incidence of complications such as bleeding, obstruction and perforation has remained steady. Perforation is the second most common complication of duodenal ulcers, and it is the second most frequent type of abdominal perforation that requires surgery, after perforated appendicitis. Since Mouret et al first described the laparoscopic repair of perforated peptic ulcers in 1990,[1] it has been gaining popularity, especially in recent years. This approach allows not only the identification of the site and pathology of perforation but also the closure of the perforation and adequate peritoneal lavage without a large incision.

The first laparoscopic repair of perforated duodenal ulcer was performed at our centre in 1995. A total of 346 surgeries have since been performed from 1995 to 2009. This study reports our experience from January 2002, when an operation room registry was established at our hospital. We evaluated the efficacy and safety of laparoscopic simple closure (LSC) of perforated duodenal ulcers, and assessed the morbidity, rate of conversion to open surgery, follow-up management and incidence of recurrence in patients during the study period.

METHODS

This was a retrospective cohort study conducted on consecutive patients who underwent laparoscopic repair of perforated duodenal ulcers from January 2002 to December 2009. The operation room registry database was used to search for consecutive patients, following which the medical records of these patients were reviewed. A total of 213 patients were identified from the registry and medical records using the International Classification of Diseases, 9th Revision (ICD-9) codes. Patients were stratified according to the American Society of Anesthesiologist (ASA) classification and Boey's score for risk factors.

All patients showed signs of peritonitis. Perforation was confirmed by erect chest radiographs that showed free air under the diaphragm. Patients' data, clinical history, duration of abdominal pain, operation time, intra- and postoperative complications, reasons for conversion to open surgery, length of hospital stay and postoperative outcomes were entered into the database for analysis. Initial management included intravenous fluid resuscitation and administration of H2-blocker and prophylactic antibiotics. The patient was kept nil per mouth and a nasogastric tube was inserted.

Surgery was carried out with the patient under general anaesthesia and in supine position, with the operating surgeon standing on the patient's left side. Operating time was measured from the time of skin incision to skin closure. Three ports were used – one 10-mm port and two 5-mm ports. The 10-mm port was inserted above the umbilicus in order to introduce the laparoscope. Under direct vision, the two 5-mm working ports

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were inserted into both the lumbar regions in the midclavicular line. The peritoneal cavity was then inspected. After the site and size of the perforation was determined, the perforation was closed using a single stitch by the intracorporeal knot-tying technique. The same suture was used to anchor a piece of the greater omentum over the perforation. At the end of the procedure, the abdominal cavity was thoroughly irrigated with several litres of saline solution. Drains were inserted according to the surgeon's preference. Nasogastric suction was continued during the first postoperative day. On the second postoperative day, after resumption of oral intake, all patients were started on triple therapy (clarithromycin, metronidazole and omeprazole) for ten days. Patients were followed up in outpatient clinics, and follow-up endoscopy was arranged for patients after six months.

RESULTS

A total of 213 patients underwent laparoscopic repair of perforated duodenal ulcers. Of these, 22 (10.3%) patients were excluded from the study, as they required conversion to open surgery. The reasons for conversion included excessive peritoneal contamination (n = 14), adhesions (n = 5) and inadequate ulcer localisation (n = 3). Laparoscopic repair of perforated duodenal ulcers was successful in the remaining 191 (89.7%) patients. Table I shows the demographics and characteristics of the cohort. The median age of the patients was 39 (range 19–73) years, while that of female patients was 50 years. The majority of patients were male. The median pre-hospital duration of symptoms was 8 (range 3–72) hours and the median time from hospital admission to surgery was 6 (range 1–12) hours. Examination of possible risk factors revealed that 15 (7.9%) patients had a history of nonsteroidal anti-inflammatory drug intake and 7 (3.7%) had a history of duodenal ulcers. Overall, 88 (46.1%) patients were smokers and 19 (9.9%) were alcohol consumers.

According to ASA classification, 58 (30.4%) patients were classified as ASA I, 83 (43.5%) patients were ASA II, 43 (22.5%) patients were ASA III and 7 (3.7%) patients were ASA IV (Table I). Based on Boey's score for risk factors, 153 (80.1%) patients had a score of 0, 36 (18.8%) had a score of 1, and only one patient scored 2. This latter patient died of heart failure. The median surgery time was 65 (range 25–190) minutes. The median size of ulcers was 1 (range 0.5–1.5) cm. All ulcers were amenable to single-stitch laparoscopic repair. The median length of hospital stay was 5 (range 2–30) days (Table I).

In all, 12 (6.3%) patients developed complications (Table I). Leakage from the suture line was encountered in two patients – one patient had generalised peritonitis and sepsis requiring re-exploration, and the other had a high output from the abdominal drain which responded to one week of conservative treatment (included nasogastric suction and octreotide). Four patients developed intra-abdominal abscesses that were amenable to percutaneous radiological drainage, except for one patient who required re-exploration. Four patients who developed postoperative paralytic ileus had prolonged hospital stay, but

Table I. Patient characteristics (n = 191).

Variable	No. (%)
Gender	
Male	180 (94.2)
Female	11 (5.8)
Age* (yrs)	39 (19–73)
Duration of symptoms* (hrs)	8 (3–72)
Time from admission to surgery* (hrs)	6 (1–12)
Duration of operation* (min)	65 (25–190)
Length of hospital stay* (days)	5 (2–30)
Length of follow-up period* (days)	36 (10–365)
Size of ulcers (cm)	1 (0.5–1.5)
Risk factors	
Smoking	88 (46.1)
Alcohol consumption	19 (9.9)
NSAID intake	15 (7.9)
History of duodenal ulcer	7 (3.7)
Preoperative anaesthesia risk	
ASA I	58 (30.4)
ASA II	83 (43.5)
ASA III	43 (22.5)
ASA IV	7 (3.7)
Postoperative complication	
Leakage	2 (1.0)
Intra-abdominal abscess	4 (2.1)
Prolonged ileus	4 (2.1)
DVT/pulmonary embolism	1 (0.5)
Pneumonia	1 (0.5)

*Data is presented as median (range).
ASA: American Society of Anesthesiologists; DVT: deep venous thrombosis; NSAID: nonsteroidal anti-inflammatory drug

Table II. Characteristics of patients admitted to the intensive care unit (n = 10).

Age (yrs)/ gender	Nationality	Reason for ICU admission	ASA status
56/M	Thai	Septic shock	III
73/M	Qatari	CAD	III
50/M	Pakistani	CAD	IV
30/M	Nepalese	Septic shock	II
48/M	Indian	CAD	IV
30/M	Indian	Septic shock	II
58/M	Bangladeshi	Septic shock	III
51/M	Bangladeshi	Pulmonary embolism	IV
68/F	Qatari	Septic shock + CAD	IV
70/F	Qatari	Septic shock	III

ASA: American Society of Anesthesiologists; CAD: coronary artery disease; F: female; ICU: intensive care unit; M: male

all four responded to nasogastric suction. One patient required treatment for pneumonia, while another was transferred to the intensive care unit (ICU) due to pulmonary embolism. There were no instances of surgical site infections.

Ten patients (ASA II n = 2; ASA III n = 4; ASA IV n = 4; median age 53.5 years) were admitted to the ICU (Table II). The reasons for ICU admission included coronary artery disease (CAD), septic shock and pulmonary embolism. The four patients with a history of CAD were classified as ASA III (n = 1) and ASA IV (n = 3).

Table III. Comparison of studies on laparoscopic repair of perforated peptic ulcers in Asian and European cohorts.

Study	Country	Sample size	Male-to-female ratio	Median age (yrs)
Mehendale et al[18]	India	34	33:1	38
Kok et al[19]	Brunei	11	10:1	39
Robertson et al[20]	UK/Australia	20	11:9	62
Naesgaard et al[21]	Norway	25	10:15	69
Miserez et al[22]	Germany	18	10:8	50
Mastuda et al[23]	Japan	14	12:2	39.8
Present study	Qatar	191	180:11	41

One of these four patients, a 68-year-old woman (ASA IV) died due to severe sepsis and cardiac decompensation. The six patients who presented with septic shock were admitted to the ICU preoperatively. One patient was transferred to the ICU postoperatively due to pulmonary embolism.

All the patients were followed up as surgical outpatients. The median follow-up period was 36 (range 10–365) days. Only 42 (22.0%) patients underwent follow-up endoscopy – 15 (35.7%) patients had normal endoscopy, another 15 (35.7%) had healed ulcer, 7 (16.7%) had gastritis and 5 (11.9%) had oesophagitis. The *Campylobacter*-like organism (CLO) test was negative in all scoped patients. None of the patients required definitive surgery.

DISCUSSION

Perforation of duodenal ulcers affects nearly 10% of patients and accounts for more than 70% of deaths associated with the disease.[2] Treatment for this condition is essentially surgical.[2] Although different techniques of ulcer repair have been described, suture repair of the perforation with an omental patch is the most popular technique.[3,4] Other types of laparoscopic repair include single-stitch laparoscopic omental patch repair,[2] simple repair alone,[5] the suture-less technique,[6] stapled omental patch repair,[7] laparoscopic repair with a falciform ligament patch[8] and gastroscopy-aided repair.[9]

Studies on laparoscopic repair of perforated peptic ulcers with minimally invasive techniques have shown decreased postoperative analgesia requirements, lower incidence of wound infection, shorter hospital stay and earlier return to work.[6] A systematic review of seven prospective and eight retrospective studies (n = 1,113) by Lunevicius and Morkevicius indicated statistically significant reductions in the use of analgesics, length of hospital stay, wound infection and mortality rate.[10] A meta-analysis of 13 trials found that laparoscopic repair was associated with significantly lower wound infection rates, reduced postoperative pain and decreased analgesic consumption.[11] However, a Cochrane review of two randomised clinical trials showed no statistically significant differences in the incidence of abdominal septic complications between laparoscopic and open surgery.[12]

Although *Helicobacter pylori* (*H. pylori*) is a major cause of peptic ulcers, acid reduction procedures are not required for this group of patients, as recurrence of post-eradication ulcer is uncommon.[13] *H. pylori* infection has been shown to be strongly related to economic conditions and age.[14] In developing countries, *H. pylori* infection occurs in younger patients, frequently during infancy, and reaches a prevalence of 70%–90% in some regions. The incidence of *H. pylori* infection is several times higher in developing countries than in developed countries.[15] A European study demonstrated that the incidence of perforated peptic ulcer has remained nearly constant over the past 50 years, although the median age of patients has increased from 41 years to 62 years and the male-to-female ratio has fallen from 10:1 to 1.5:1.[16] A regional study by Bener et al found a high prevalence of *H. pylori* infection among workers of low socioeconomic status.[17]

Keeping in mind the high prevalence of *H. pylori* infection reported by regional and international studies,[15,17] all our patients were empirically started on triple therapy once they were able to eat postoperatively. The patients in our series were younger (median age 39 years), although female patients were older (median age 50 years), and there was a male preponderance (male-to-female ratio 17:1). The younger age and male predominance in our cohort was due to the fact that three-quarters of our patients were workers of low socioeconomic backgrounds from the Indian subcontinent who have a high rate of *H. pylori* infection. This is in keeping with Mehendale et al's study from India, which reported a median age of 38 years and a male-to-female ratio of 33:1.[18] Studies from Europe, however, reported older patients and a much lower male predominance. Table III shows a comparison of the studies conducted on laparoscopic repair of perforated peptic ulcers in cohorts from Europe and Asia.[18-23]

The conversion rates of laparoscopic surgery to open repair have been reported to range from 0% to 27%,[5,6,18,23-28] which are comparable to the rate of 10.3% (22/213) in our study. The reasons for conversion in our series included excessive peritoneal contamination (n = 14), adhesions (n = 5) and inadequate ulcer localisation (n = 3). Although drains were used routinely at the beginning of our study, they were seldom used subsequently. The decision to convert to open surgery and the use of drains were largely based on the individual surgeon's preference.

Despite its increasing popularity, the use of laparoscopic repair to treat perforated peptic ulcers remains controversial due to concerns regarding a longer operation time, leakage and the high rate of reoperation.[11,19] Table IV shows a comparison of the median operation time, length of hospital stay and patient outcomes among various studies.[5,6,18,23,27,28] Postoperative

Table IV. Comparison of outcomes of various studies on laparoscopic repair of perforated peptic ulcers.

Study	Sample size	Median age (yrs)	Male-to-female ratio	Conversion (%)	Median operation time (min)	Median length of hospital stay (days)	Morbidity (%)	Mortality (%)
Seelig et al[5]	24	49	16:8	12	65	9	12	0
Lau et al[6]	24	52	20:4	20	112	5	21	0
Mehendale et al[18]	34	38	33:1	18	50	4	NA	0
Mastuda et al[23]	14	39	12:2	21	135	17	7	0
Druart et al[27]	100	52	64:36	8	80	9	9	5
Bhogal et al[28]	19	54	13:6	0	61	3	5	0
Present study	191	41	180:11	10	65	5	6	0.5

NA: not available

complications occurred in 12 (6%) patients in the present study. No surgical site infections were encountered and none of our patients was readmitted for definitive surgery – most probably due to the eradication of *H. pylori* infection using triple therapy, which was also prescribed for patients who required open surgery.

In conclusion, laparoscopic repair of perforated duodenal ulcers is a safe and reliable option that is associated with low morbidity. Coupled with triple therapy, it results in a low incidence of subsequent definitive surgery.

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